

3.—THE HELMINTHS OF WESTERN AUSTRALIAN STOCK.

Recorded and Unrecorded Species.

(With Four Figures, 4, 5, 6, 7.)

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(Read 14th June, 1927. Published 24th October, 1927.)

In the course of my departmental duties during the past two years opportunities for the collection of helminths, both from material received at the laboratory and investigated in the field have been freely accepted.

The endoparasites of this State have been rather neglected, so that even many of the commoner species, affecting stock, have not been recorded, though in many cases their presence has been assumed.

(A) Recorded Species.

Sweet (1908) (a) gives the following list of species as having been recorded from W.A., Cleland, in most instances, being the original recorder—

1. Trematodes.

Fasciola hepatica (in *Ovis aries* and *Bos taurus*).

Paramphistomum cervi Zed. (in *Bos taurus*).

Both these records are for imported Eastern States beasts, not for W.A. stock.

2. Cestodes.

Moniezia denticulata (in *Bos taurus*).

Echinococcus polymorphus (in *Ovis aries*, *Bos taurus*, and *Sus scrofa*).

Cysticercus tenuicollis (in *Ovis aries* and *Sus scrofa*).

Thysanosoma ovilla (in *Ovis aries*).

3. Nematodes.

Ascaris lumbricoides (in *Sus scrofa*).

Habronema megastoma (in *Equus caballus*).

Spiroptera sp. (in *Bos taurus*).

Metastrongylus apri (in *Sus scrofa*).

Dictyocaulus filaria (in *Ovis aries*).

Dictyocaulus viviparus (in *Bos taurus*).

Synthetocaulus rufescens (in *Ovis aries*).

Filmer, 1926, in a departmental communication (W.A.), in enumerating species, gives the following additional:—

1. Nematodes.

Onchocerca gibsoni—stated to be very common in Kimberley cattle; and has occasionally been seen in the cattle bred in the more southern districts. The *Spiroptera* sp. found in nodules by Cleland in 1907 he later referred to this species.

Oesophagostomum columbianum, larvæ recorded from cattle by Cleland in 1908 (b).

Haemonchus contortus recorded by Weston (c) in sheep. Filmer also reports it from cattle.

Chabertia ovina was reported by Weston in sheep in association with the above-mentioned species.

Ascaris megalocephala is also reported for the horse.

Other species enumerated, but not identified, by Filmer have been diagnosed by the writer and are given under the heading of unrecorded species.

With reference to the incidence of the recorded species, I have not as yet met with either species of Trematode. There appears to be no evidence of the existence of *Fasciola hepatica* in W.A. bred sheep, despite the certain introduction of the parasite for many years with sheep imported from the other Australian States.

Adult Cestodes are not uncommon in sheep or cattle, but none collected have been identified. *Echinococcus* cysts and *Cysticercus tenuicollis* are of course frequently met with in the hosts they are recorded for.

Of the Nematodes, *Ascaris* is very common in pigs and horses. *Habronema megastoma* nodules have been found in the great majority of the horses' stomachs received for investigation. *Dictyocaulus filaria* is common and has a wide distribution, though in my experience heavy infestations are relatively uncommon.

On the other hand, *Haemonchus contortus* appears to find conditions favourable in many districts. Heavy mortalities in sheep, particularly weaners, due to *Haemonchus contortus* alone, or in association with stomach worms, notably *Ostertagia* spp., are being continually brought under the notice of this department. I have also received specimens of *Haemonchus contortus* from cattle.

Chabertia ovina has been found in a large percentage of sheep examined and has a wide distribution.

Lesions in the intestines of cattle and pigs identical with those of Oesophagostomiasis have frequently been encountered, but no detailed examinations have been made. Worm nodules assumed to be those of *Onchocerca gibsoni* have been seen commonly in the shipments of North-West cattle and twice in locally bred cattle.

(B) Unrecorded Species.

As species here recorded have, with the probable exception of four, been described as being present in Australia, full detail is not given. Where available original descriptions have been followed, otherwise recognised monographs, and text books have been relied on for diagnosis. Only special features presenting themselves have been mentioned.

In dealing with Nematodes the classification given by Yorke and Mapleston (d) has, in general, been followed.

Specimens have been preserved in 70 per cent. alcohol, and Nematodes have been cleared and examined in Carbolised absolute.

1. Trematodes.

To date none have been received.

2. Cestodes.

(1) *Choanotaenia infundibuliformis* (Goeze., 1792).

= *Drepanidotaenia infundibuliformis* Railliet, 1892.

Host—Fowl: intestines.

Locality—Markets, Perth, 14/5/26.

Remarks—Bird seized for emaciation due to other causes.

(2) *Davainea* sp.?

Segments only.

Host—Fowl: intestine.

Locality—Perth, 15/1/26.

Remarks—At the time of collection these specimens were referred to above, but as they were not retained, further examination is impossible.

(3) *Dipylidium caninum* (Linne, 1767).

= *Taenia canina* (Linne, 1767).

= *T. cucumerina* (Bloch, 1782).

= *T. elliptica*:

Segments only.

Locality—Dumbleyung, July, 1925.

Remarks—The parasite is quite probably a common one, but very little canine material has been available for examination.

3. *Nematodes*.

(1) *Trichuris suis* (Schränk, 1788).

= *Trichocephalus apri* (Gmelin, 1790).

= *Trichocephalus crenatus* (Rud., 1809).

Host—Pigs: caecum and colon.

Locality—Various.

Remarks.—Apparently a frequent and widely distributed parasite of pigs in this State.

(2) *Strongylus equinus* (Mueller, 1780.)

= *Sclerostomum equinum* (Mueller, 1780; Looss, 1900).

= *Strongylus armatus* (Rud., 1802).

Host—Horses: intestines.

Locality—Perth, August, 1926.

Bruce Rock, 16/2/27.

Remarks.—This species has been frequently noticed in horses in the Metropolitan Area.

(3) *Strongylus edentatus* (Looss, 1900).

Host—Horse: intestines.

Locality—Perth, 3/1/26.

(4) *Strongylus vulgaris* (Looss, 1900).

Host—Horse: intestine.

Locality—Bruce Rock, 16/2/27.

Remarks—Also noted in Metropolitan Area.

(5) *Trichonema longibursatum* (Yorke and Macfie, 1918). (e)

= *Cylicostomum longibursatum* (Yorke and Macfie, 1918).

= *C. caliciforme* (Koltan, 1920).

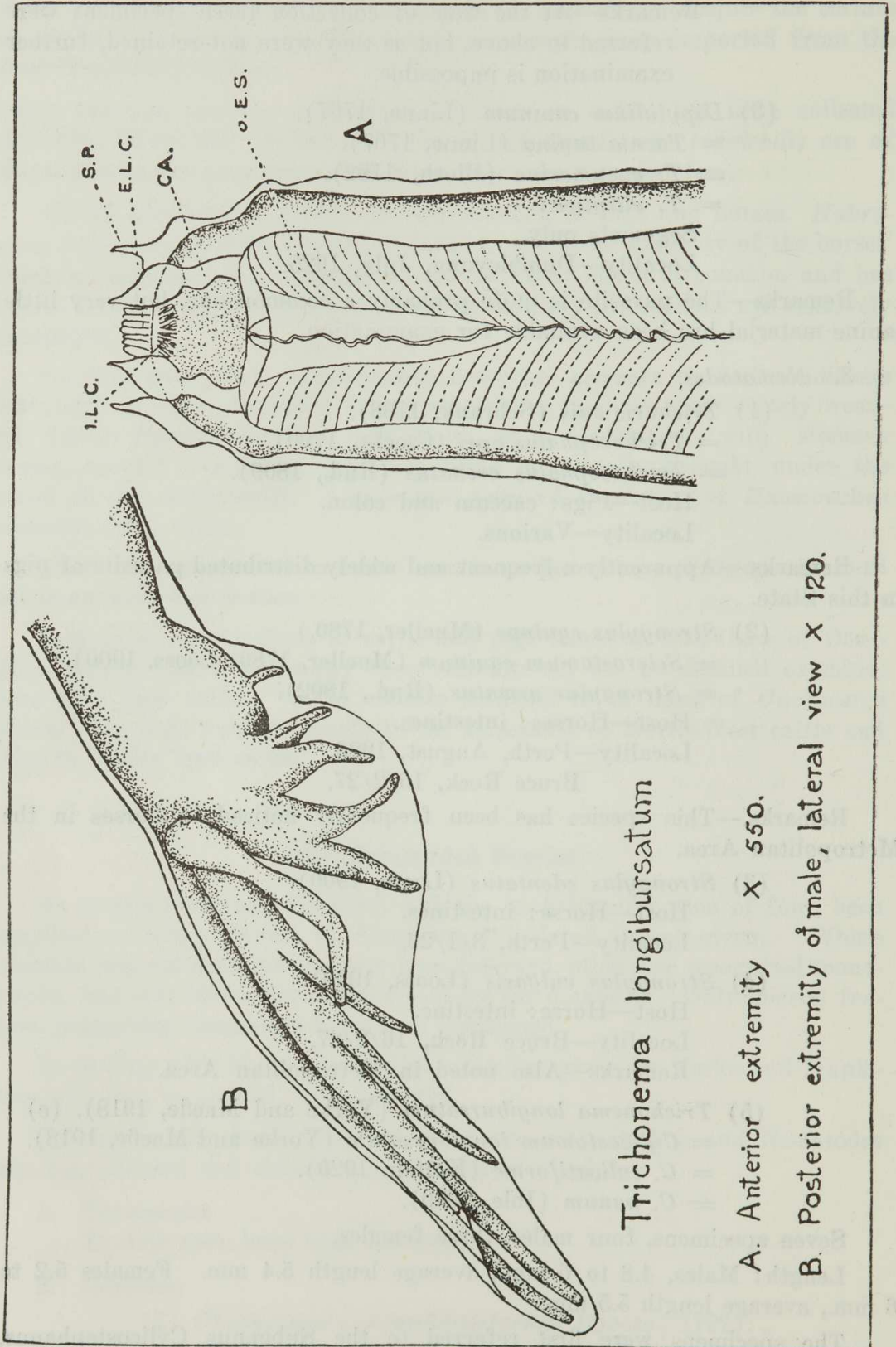
= *C. nanum* (Ihle, 1919).

Seven specimens, four males, three females.

Length: Males, 4.8 to 6 mm., average length 5.4 mm. Females 5.2 to 6 mm., average length 5.5 mm.

The specimens were first referred to the Subgenus *Cylicostephanus*, Ihle 1924, as quoted by Yorke and Maplestone. Following this, the details in all specimens have been carefully compared with those of the original descriptions of *T. longibursatum*, and, except where otherwise mentioned, concur with them.

Fig. 4.



Trichonema longibursatum

A. Anterior extremity X 550.

B. Posterior extremity of male, lateral view X 120.

No transverse section of the mouth capsule was made.

The original description is easy of access to Australian workers; the main diagnostic characters as given for the type species are—

- (1) "Very small size; average length, male and female, 5.1 mm.
- (2) Buccal capsule: anterior opening circular; walls, when seen in optical section, kneed; ratio of breadth, at anterior opening to antero-posterior diameter, 1 to 1.
- (3) Dorsal oesophageal gutter projects slightly into buccal capsule.
- (4) Dorsal lobe of bursa very long and narrow; ratio of length of posterior ray to total length of male worm, 1 to 8.
- (5) Termination of female body and tail straight."

The only divergencies in my specimens from the above-mentioned characters were—

Greater length, average, males 5.4 mm.; females 5.5 mm.; as against 5.1 for both males and females of *T. longibursatum*. Yorke and Macfie give, however, 5.5 mm. as the maximum length for the male and 5.7 mm. for the female. Again, the ratio of the length of the posterior (dorsal) ray of the bursa to the total length of the body of the male is as 1 to 7.8 as against 1 to 8 for *T. longibursatum*. Otherwise the quoted description fits the W.A. specimens.

More detailed divergencies from the original description were that the walls of the buccal capsule (vide Fig. A) appear rather stouter than those illustrated for *T. longibursatum*. In the mouth capsule the average antero-posterior diameter of seven worms is 19.3 microns with a variation of 18.6 to 20 microns; as against *T. longibursatum* 19 microns with a variation of 17.5 to 20 microns. The lateral diameter at the anterior openings averaged (seven worms) 19.5 microns with a variation of 18.6 to 21 microns; as against *T. longibursatum* 19 microns with a variation of 18 to 20 microns. That of the posterior opening averaged 27.4 microns (seven worms) with a variation of 24.8 to 29.5 microns; as against *T. longibursatum*, average 26 microns with a variation of 24 to 28 microns. In two males examined the length of the main trunks of the posterior (dorsal) ray were 750 to 765 microns. The corresponding measurement for 10 specimens of *T. longibursatum* is given as 594 to 659 microns with an average of 631 microns. The bursa apart from the slightly longer dorsal ray is identical with that of *T. longibursatum*. Plate 24.

The specimens described appear to be very slightly larger than *T. longibursatum*, but despite this fact, in view of the almost exact concurrence in detail with the original description, I think that a definite diagnosis for Western Australian specimens is justified.

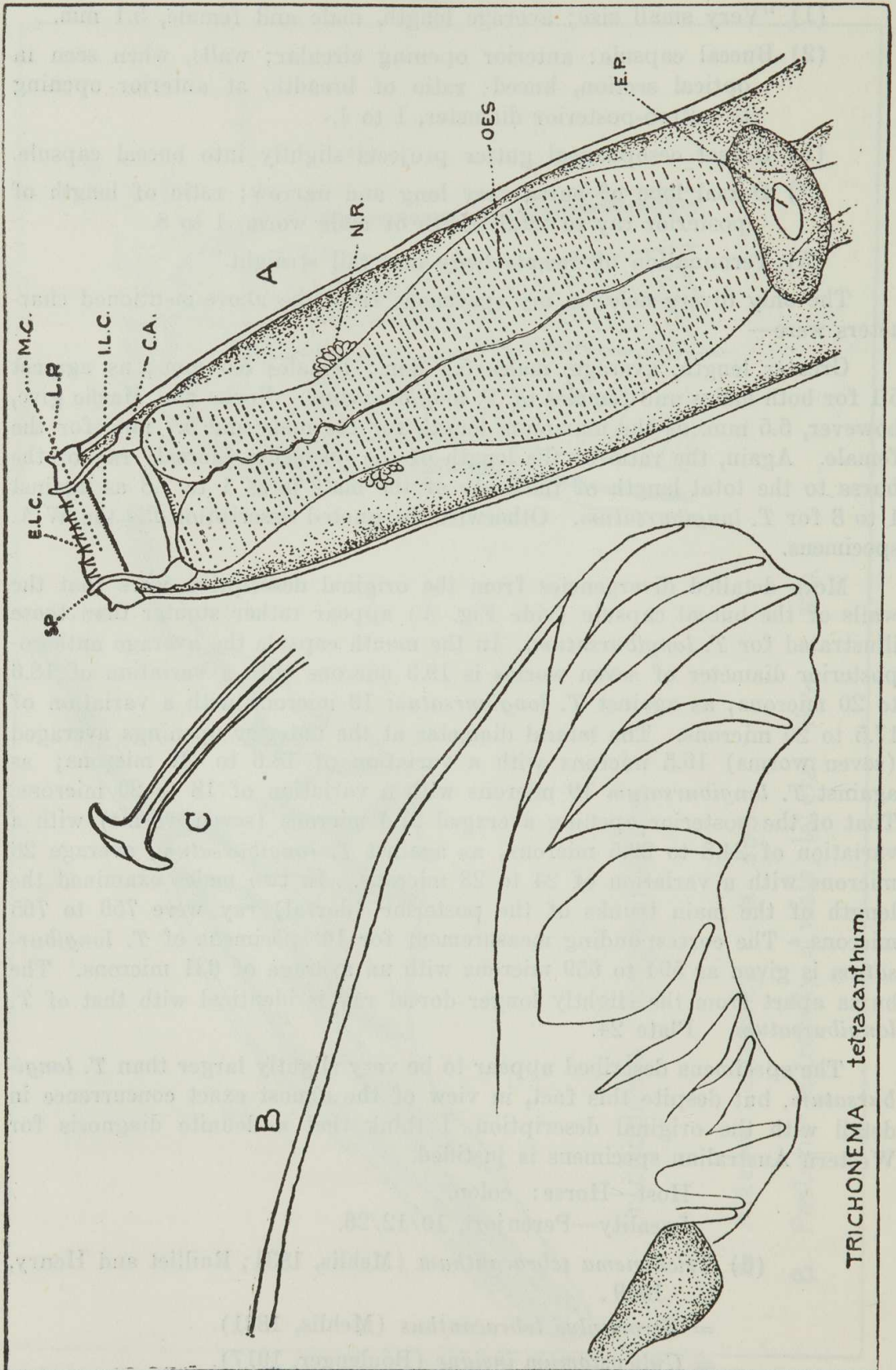
Host—Horse: colon.

Locality—Perenjori, 10/12/26.

- (6) *Trichonema tebracanthum* (Mehlis, 1831; Railliet and Henry, 1919.
 = *Strongylus tebracanthus* (Mehlis, 1831).
 = *Cylicostomum insigne* (Boulenger, 1917).

Four specimens, two males and two females. Length—males both 10 mm.; females 12 and 14 mm. The diagnosis is based on comparison with Cram's Key to "Strongylidae of the Horse, Donkey, Mule and Zebra," (k)

Fig. 5.



TRICHONEMA tetraanthum.

and Boulenger's original description of *C. insigne* (f), these being the only references available. By means of Cram's Key the specimens were put into the genus *Trichonema* Cram, 1924 = Subgenus *Cylicocylus* Ihle 1922, as quoted by Yorke and Maplestone, and were referred to *T. tebracanthum*. The specific characters of the specimens examined agreed accurately with those described by Boulenger for *C. insigne* which Cram states has been shown by Railliet to be identical with *Trichonema tebracanthum* (Mehlis, 1831). The main characters of the subgenus *Cylicocylus* are—

“Posterior margin of mouth capsule with a hoop-like thickening, the elements of the internal leaf crown small and originating near anterior margin of mouth capsule. The posterior extremity of the female straight or slightly bent dorsally.”

In specific characters the specimens examined differ from those described only in that the males were slightly below the given length, viz., 10 mm. instead of 11 to 12 mm., and in that the number of teeth in the external leaf crown appeared to be about thirty instead of “about thirty-six.” Important characters for specific identification were the absence of dorsal gutter and the fact that the excretory pore was at junction of œsophagus and intestine (A, Fig. 4). The characters of the kursa (B, Fig. 5) did not differ markedly from those given for *C. insigne*. The microscopic measurements of the four specimens examined were in accord with those described for *C. insigne*, viz., Mouth capsule has a depth of 56 to 70 microns, and a maximum breadth of 140 to 170 microns. Oesophagus, length 720 to 900 microns, maximum breadth 240 to 300 microns. The cervical papillae 900 to 950 microns from anterior extremity.

In the females—maximum breadth near middle of body 825 to 850 microns; vulva 375 and 405 microns from posterior extremity, and at this level body has a width of 300 microns; anus 165 and 240 microns from posterior end; eggs averaged about 75 x 50 microns.

In the males, maximum breadth was 700 and 750 microns, slightly broader than that described for the species, viz., 620 to 690 microns.

Host—Horse: colon.

Locality—Perenjori, 10/12/26.

Remarks.—Not to my knowledge any previous record for Australia. This species was present in great numbers in association with preceding species.

(7) *Ostertagia ostertagi* (Stiles, 1892).

= *Strongylus ostertagi* (Stiles, 1892).

= *S. convolutus* (Ostertag, 1890).

= *S. cervicornis* (McFadyean, 1897, in part).

= *S. harkeri* (Stodter, 1901, in part).

Host—Heifer: nodules in abomasum.

Locality—Denmark, 18/1/27.

Remarks.—Parasites—presumably this species—have been noted by officers of this department, in similar lesions, for some years, particularly in the South-West of the State. Their presence has been associated with a similar syndrome to that observed at Denmark; the condition which particularly affects young cattle is characterised by progressive emaciation, intermittent diarrhoea, and ravenous appetite. Death follows if cattle are not given a change of country. It is not yet decided, however, whether the parasite is primarily responsible for the trouble, there being some evidence of mineral deficiency acting concurrently.

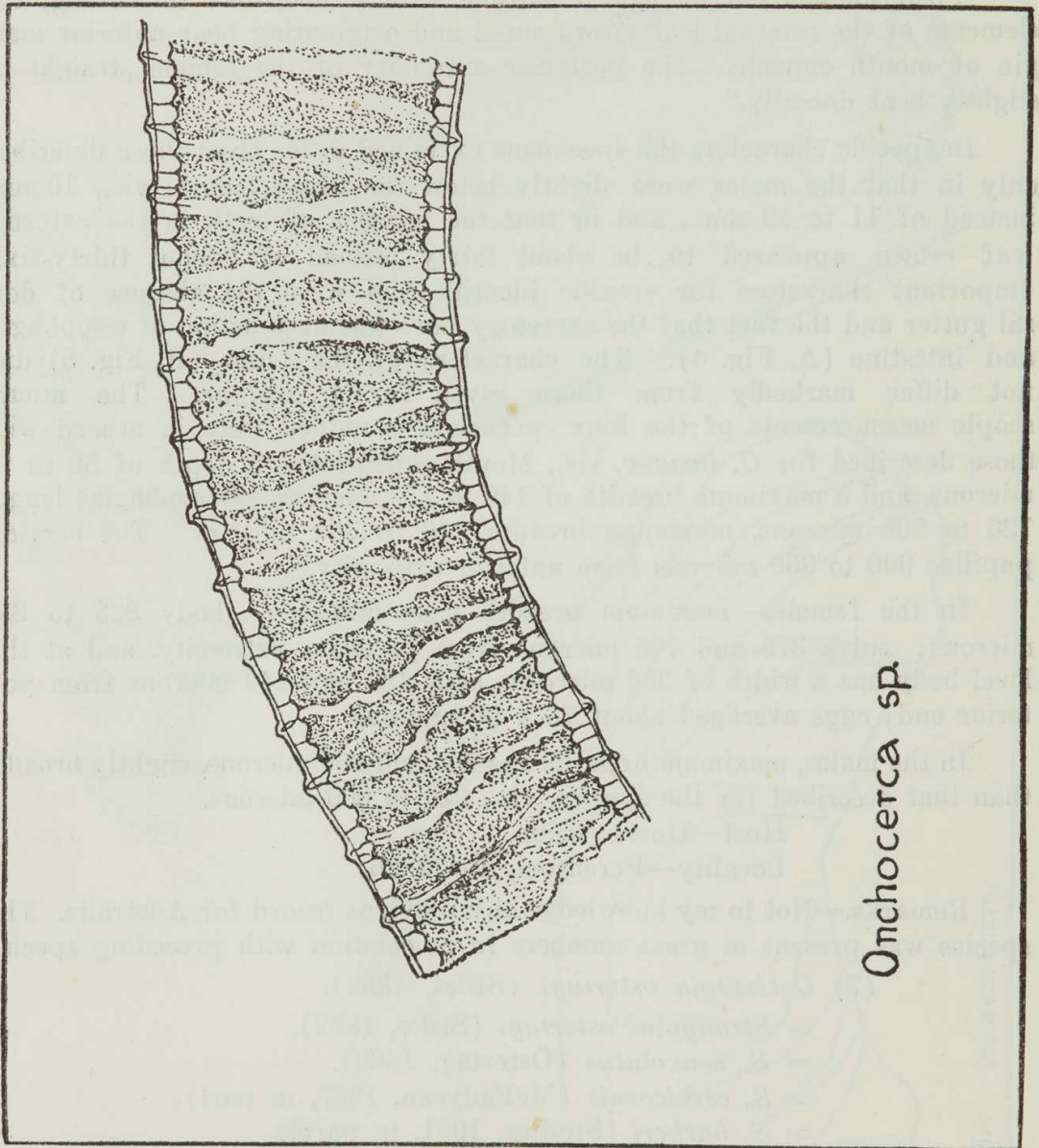
(8) *Ostertagia* sp.

Numerous specimens differing from the above mainly in absence of cuticular flap covering vulva in the female have been received at different times.

Host—Sheep: abomasum (free).

Locality—Chittering, Dinninup, etc.

Fig. 6.



Onchocerca sp.

Remarks.—This species is sometimes found in association with *H. contortus*. In the absence of necessary literature I am unable at present to give a specific identification.

(9) *Oxyuris equi* (Schrank, 1788).

= *Trichocephalus equi* (Schrank, 1788).

= *Oxyuris curvula* (Rud., 1803).

= *Oxyuris mastigodes* (Nitzsch, 1857).

= *Lepturis curvula* (Rud., 1803; Schlotthauber, 1860).

Two specimens, both females, first 2.5 cm. long, second 5.5 cm. long. First was sexually mature and in all respects except small size; Yorke and Maplestone give 4 cm. as minimum length; identical with this species.

Host—Horses: rectum.

Locality—Perth, First specimen, 1/3/26.

Second specimen, 4/2/27.

This species has often been seen but has not been recorded for this State.

(10) *Toxocara canis* (Werner, 1872).

= *Lumbricus canis* (Werner, 1872).

= *Ascaris wernerii* (Rud., 1793).

= *Ascaris marginata* (Rud., 1802).

= *Belascaris marginata* (Rud., 1802; Railliet and Henry, 1911).

Host—Dog: intestines.

Locality—Perth, 20/11/26.

(11) *Ascaridia lineata* (Schneid, 1866).

= *A. hamia* Lane, 1914.

Thirteen specimens, six males, seven females. Lengths—males 4.5 to 5.7 cm., females 5.8 to 7.2 cm.

The diagnosis is based on comparison of the specimens with descriptions of *A. lineata* given by Schwartz (g). The number and arrangement of the genital papillae in the males corresponded in every case with those described for this species.

They are ten in number with the following arrangement:—"The first group consisting of three pairs (ventral) arranged in a linear series on each side of the sucker, the second group consisting of four pairs (three lateral and one ventral), and the last group consisting of three pairs (two lateral and one ventral)." Vide Text Fig.

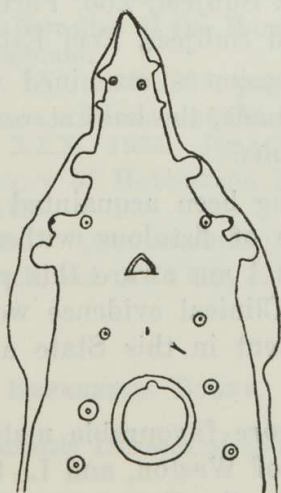
Host—Fowl: intestines.

Locality—Perth, Oct., 1926.

Remarks.—*Ascaridia* sp. in fowls, which on all occasions where a detailed examination has been made, have been found to be *A. lineata*, are widely distributed over the Metropolitan Area and probably outside it. Heavy infestations appear to be associated with lowered egg production.

Apparently not recorded as such in Australia.

Fig. 7.



A. scaradia lineata
(original) x 23.

- (12) *Heterakis vesicularis* (Frolich, 1791).
 = *Ascaris papillosa* (Bloch, 1782, in part).
 = *Ascaris vesicularis* (Frolich, 1791).

Host—Fowl: caecum.

Locality—Perth, 6/1/26.

Remarks.—Specimens apparently this species have been noted on several occasions, but not as commonly as *A. lineata*.

- (13) *Habronema microstoma* (Schneider, 1866).

The specific details agree with those given by Ransom (h).

Host—Horse: stomach.

Locality—Perth, 2/12/25.

Remarks.—This species has only been observed on this one occasion.

- (14) *Habronema muscae* (Carter, 1861).

= *Filaria muscae* (Carter, 1861).

Three specimens, all females. The specific details agree with those given by Ransom (h).

Host—Horse: stomach.

Locality—Perth, 29/3/27.

Remarks.—This specimen has only been noted on a few occasions, but is probably not uncommon.

- (15) *Onchocerca* sp., probably *O. cervicalis* (Railliet and Henry, 1910).

Numerous incomplete specimens; one male almost complete, posterior extremity being mutilated, was 34 mm. long with maximum breadth of 150 microns, head 50 microns wide. One portion of a female was 73 mm. long, breadth 250 to 350 microns. The worms were filiform and refractile, except degenerated portions which were white and brittle. In two heads examined mouth was simple without lips or papillae.

The cuticle in the female was transversely striated and, characteristically, as described for the genus, reinforced externally by spiral thickenings (Plate XXV.) absent in the male.

Host—Horse: ligamentum nuchae and inflammatory fibrous tissue, in one subject (fistulous wither).

In discharge from fistula in second subject.

Locality—1st Subject, Zoo, Perth, 24/3/27.

2nd Subject, Peel Estate, 31/3/27.

Remarks.—Though the specimens examined were not complete enough for a specific diagnosis to be made, the habitat would suggest that the specimens were probably *O. cervicalis*.

Robson, of Perth, has long been acquainted with these worms and regards them as frequent cause of fistulous withers. He has described the clinical aspect (i). As far as I am aware this parasite has not previously been recorded in Australia. Clinical evidence would indicate that its incidence is by no means infrequent in this State and would ascribe to it an important pathological rôle.

I am hoping to obtain more favourable material. The first specimens were obtained by the courtesy of Weston, and Le Souef, from diseased tissue of a horse which was killed at the Zoo, having been affected with a long standing fistula. The undegenerated specimens were few in number and

were embedded in healthy elastic tissue being difficult to find. Time did not permit of the careful dissection required to obtain whole specimens being made. Chalky foci were present in the diseased tissue and were probably, as suggested by Robson, originally areas of parasitic invasion.

The second specimen forwarded from a Government horse at the Peel Estate by Senior Agricultural Advisor J. T. Armstrong, was portion of a partially degenerated female embedded in inspissated pus which was discharged from the fistula.

Robson states that in earlier acute cases of fistulous withers the parasites are very numerous and are found free in pockets of pus, etc., but later degenerate. Before this degeneration takes place surgical procedure is said to be of little avail.

Cases of "dropped shoulder" in unbroken horses are also ascribed by some to the effect of these parasites.

There is no information as to their incidence in normal horses, but this question is to be investigated.

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EXPLANATION OF FIGURES.

All figures drawn by aid of Camera lucida.

Fig. 4.—*Trichonema longibursatum* (Yorke & Macfie, 1918).

A.—Anterior extremity X 550.

I.L.C. = Internal leaf crown.

S.P. = Submedian head papilla.

E.L.C. = External leaf crown.

C.A. = Wall of mouth capsule.

O.E.S. = Œsophagus.

B.—Posterior extremity of male, lateral view X 120.

Fig. 5.—*Trichonema tetracanthum* (Mehlis, 1831).

Railliet & Henry, 1919.

A.—Anterior extremity X 100.

M.C. = Mouth collar.

L.P. = Lateral head papilla.

N.R. = Nerve ring.

E.P. = Excretory pore.

B.—Ventrolateral view of bursa X 80.

C.—Terminations of spicules X 550.

Fig. 6.—*Onchocerca* sp.

Portion of female worm X about 100, showing spiral thickenings reinforcing cuticle.